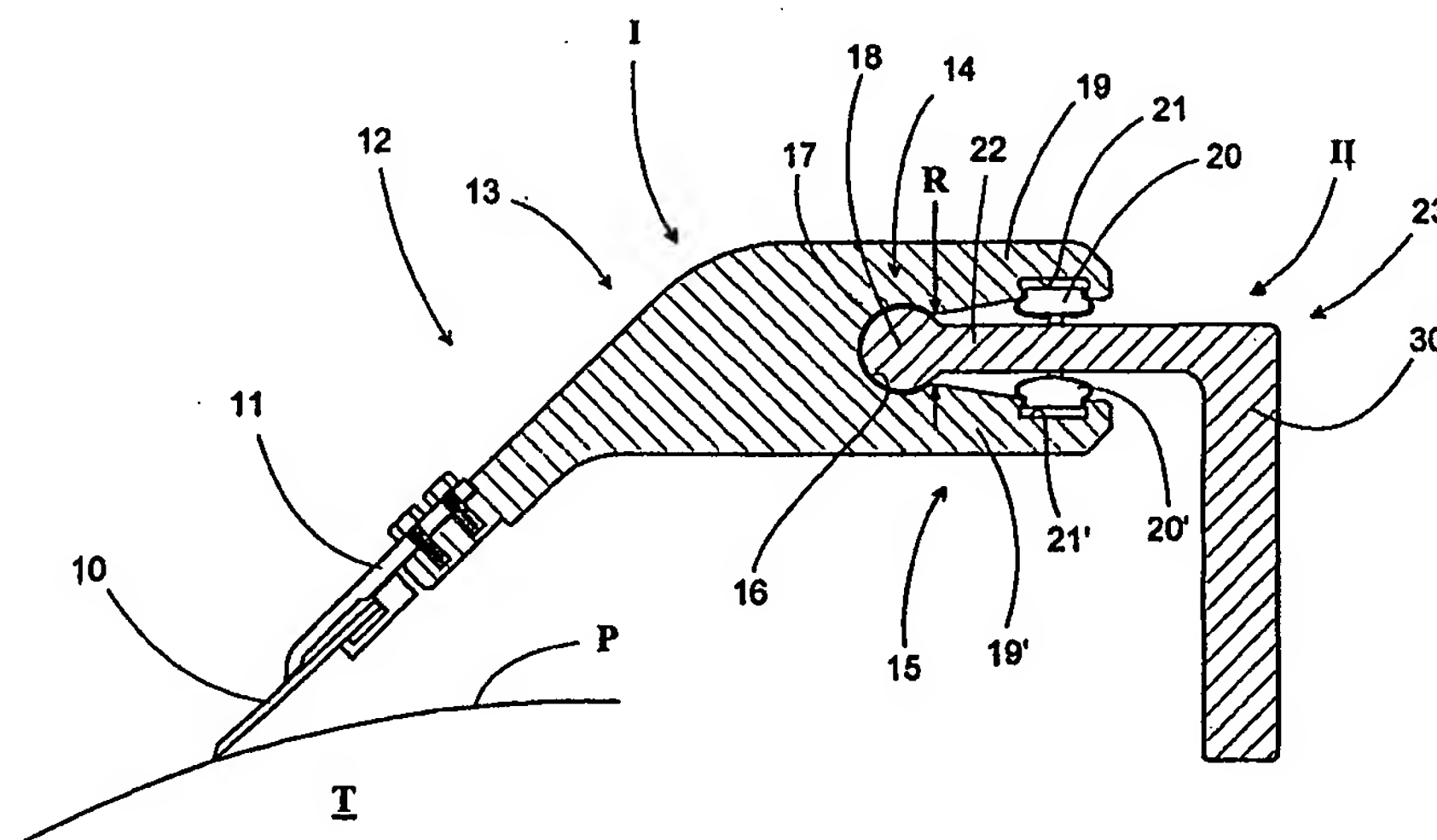




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<p>(21) International Application Number: PCT/FI00/00064</p> <p>(22) International Filing Date: 1 February 2000 (01.02.00)</p> <p>(30) Priority Data: 990196 3 February 1999 (03.02.99) FI</p> <p>(71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): HASSINEN, Reijo [FI/FI]; Jussilantie 5, FIN-41310 Leppävesi (FI). SALMINEN, Samppa, J. [FI/FI]; Roninmäentie 20, FIN-40500 Jyväskylä (FI).</p> <p>(74) Agent: KESPAT OY; P.O. Box 601, FIN-40101 Jyväskylä (FI).</p>	<p>(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Finnish).</p>	

(54) Title: DOCTOR ASSEMBLY IN A PAPER MACHINE WITH A JOINTED BEARING



## (57) Abstract

The invention relates to a doctor assembly in a paper machine, which is intended to clean, e.g., a roll (T), and which includes a surface (P) against which a doctor blade (10) is set, a blade support (12) for supporting the doctor blade (10), a frame (23), a jointed bearing assembly (14), which supports the doctor blade (10) and is itself supported from the frame (23), and which is parallel to the doctor blade (10), and extends essentially over the entire width of the roll, and loading devices (20, 20') between the blade support (12) and the frame (23) for turning the doctor blade (10) in relation to the frame (23) and for pressing the doctor blade (10) against the surface (P) with a selected pressure. Due to the continuous support, there is essentially no deflection in the doctor assembly, when it is attached by its frame directly to the structures of the paper machine.

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### Doctor assembly in a paper machine with a jointed bearing

The present invention relates to a doctor assembly in a paper machine, which is intended to clean a moving surface, such as  
5 a roll, felt, or wire. The doctor assembly includes

- a doctor blade set against the moving surface
- a blade carrier for supporting the doctor blade
- a frame
- a jointed bearing assembly supporting the blade carrier, and  
10 itself supported from the frame component, and parallel to the doctor blade, and
- loading devices between the blade carrier and the frame, for rotating the doctor blade in relation to the frame and for pressing the doctor blade against the surface with a selected  
15 force;

and in which the jointed bearing assembly between the blade carrier and the frame comprises an operational joint sleeve fixed in one of these components and an operational joint pin fixed in the opposing component, the joint pin being installed  
20 to be able to rotate in the joint sleeve.

Here, a paper machine refers broadly to all similar machines, particularly also to board machines. In these machines, a doctor assembly is used to keep the rolls clean. The doctor  
25 blade of the doctor assembly cleans fibre residue and water from the surface of the roll and, in case of a web break, guides the web in the desired direction. Doctor assemblies are also used in connection with other moving surfaces, such as felts and wires, in addition to rolls.

30

A doctor assembly is usually built on a doctor beam, which is set in bearings so that it can be rotated and moved slightly axially, so that it can be moved backwards and forwards with the aid of an oscillating device. The rotatable doctor beam may  
35 also have two or more doctors attached to it, each with its own adjustable blade holder. If the doctor beam can be turned, it

is used to set the doctor blade in either a maintenance or an operating position. An adjustment device forming part of the doctor assembly is then used to set each doctor blade against the surface with a selected pressure. The doctor assembly  
5 includes a holder frame, a jointed bearing assembly, and loading devices, which are generally placed on both sides of the cross-section of the joint.

The doctor blade, blade holder, and holder frame extend unbroken over the entire width of the paper machine. Similarly, the frame and the hoses used as loading devices extend unbroken over the entire width of the paper machine. A jointed bearing assembly, on the other hand, is often only implemented at the ends of the holder frame, in which case the deflection of the  
15 latter becomes a problem. US patent publication 4,906,335 discloses a doctor assembly, in which the blade holder is supported by several joint members set at intervals. Such assemblies are not, however, in use. Due to the construction of the doctor assembly, the replacement of the doctor blade, or  
20 maintenance in general has required the doctor assembly to be turned to a special maintenance position, which is implemented by means of a rotating doctor beam construction. Oscillation has also been connected to this doctor beam.

25 Known doctor assemblies are extremely heavy, because the doctor beam must be made robust, so that it will turn the blade holder sufficiently also in the centre of the beam, despite deflection. Similarly, the holder frame carrying the doctor blade has generally had to be made quite sturdy, to allow for the great  
30 distance between the jointed bearing assemblies.

The present invention is intended to create an entirely new kind of doctor assembly, which is considerably lighter and easier to operate than previous doctor assemblies. The characteristic features of the doctor assembly according to the  
35 invention are described in the accompanying Claim 1. Because

the doctor assembly is supported essentially over its entire width, it no longer need be dimensioned on the basis of deflection. A doctor beam is no longer required, as the doctor assembly is attached directly to the doctor frame. The continuous support is preferably implemented by means of a continuous joint, so that the blade holder can be simply pulled along the joint to replace the blade or for maintenance. According to one preferred embodiment, the joint sleeve is set in the bottom of a structure with a U-shaped cross-section. Both the joint and the loading members are then protected against dirtying. According to another preferred embodiment, a heavy doctor beam with its rotating devices is no longer required at all, as the doctor blade with the blade holder can be pulled out along the longitudinal jointed bearing assembly. Other embodiments and advantages of the invention will become apparent in connection with the following examples of embodiments.

In the following the invention is described with reference to the accompanying figures, in which

20

Figure 1 shows a cross-section of one doctor assembly according to the invention.

Figure 2 shows another embodiment of a doctor assembly according to the invention.

25 Figure 3 shows ways of installing a doctor assembly according to the invention in a paper machine.

Figure 4 shows one embodiment of the joint axle of a doctor assembly according to the invention.

30 In Figure 1, a doctor assembly according to the invention is installed in connection with roll T. The doctor blade 10 scrapes the surface P of roll T. Doctor blade 10 is attached to blade holder 11, which is in turn attached to holder frame 13, which includes a U-shaped structure 15. Joint sleeve 16 is formed in the bottom of this U-shaped structure. The parts supporting doctor blade 10 related to this joint 16 are re-



ferred to in general as blade support 12. The other component, joint pin 17, of jointed bearing assembly 14 is formed into a unified axle 18 at the end of the thin flange area 22 of frame 23. In this case, the thin flange area is part of frame 23, which in turn also forms a bearer 30 for attaching the doctor assembly to the frame structures of the paper machine.

Here doctor blade 10 and blade holder 11 are, in a known manner, essentially the same width of the roll. On the other hand, an entirely new feature is that jointed bearing assembly 14 also extends over the entire width of the roll. Generally, jointed bearing assembly 14 always extends over the essential part of the width of doctor blade 10, either continuously or discontinuously. The thin flange area 22 extends to joint pin 17, through gap R. The axle 18 formed by joint pin 17 can rotate to a limited extent within the limits permitted by gap R and the claws 19 and 19' of the U-shaped structure 15.

In this case, loading devices 20, 20' are arranged in an area protected from dirtying on each side of thin flange area 22, between claw 19/19' and thin flange area 22. Here, the loading hoses normally used in doctors and coating machines are used as the loading devices. These are installed in grooves 21 and 21' made in claws 19 and 19' of the U-shaped structure 15.

25

The oscillating device is preferably attached to holder frame 13, so that the oscillating movement takes place in jointed bearing assembly 14. The oscillating mass is a fraction of that in known constructions.

30

Because the bearing surfaces of jointed bearing assembly 14 are distributed over the entire width of the roll, the loading pressure remains quite low. In this case, it is possible to consider jointed bearing assembly components, which in this case are formed by extruded or pultruded pieces, generally marked with the reference numbers I and II. In installation,

blade holder 11 with blade 10 is attached to the holder frame 13 and loading hoses 20 and 20' are set in their grooves 21 and 21'. Next, this totality is pushed axially onto frame 23, so that joint sleeve 17 slides over joint pin 16 and loading hoses 5 20 slide along both sides of thin flange area 22 of frame 23. Next, the oscillating device is connected and the pressure medium connections are connected to the loading hoses.

The doctor assembly created is quite simple and light. The 10 jointed bearing assembly is in a fully protected space, isolated by the loading devices, which themselves are in a well protected space, especially if the jointed bearing assembly is continuous over its entire length. The loading pressures on the jointed bearing assembly remain, as stated above, fairly low, 15 so that there may be no necessity for the separate machining of the bearing surfaces.

In principle, the construction according to Figure 1, can be turned around, so that piece I containing the joint sleeve is 20 in frame component 23 and correspondingly blade support 13' contains joint 17, thus forming piece II. The loading devices and the joint can then be easily protected by separate guards 25, which can be formed from a protective fabric or a sheet of rubber, Figure 2.

25

The lower jaw of the blade holder of Figure 2 is integrated with the rotating frame component, the blade holder comprising a simple retaining strip 11, for locking doctor blade 10 in place.

30

If necessary, liquid-lubrication is arranged in the jointed bearing assembly, for example water flushing for diminishing the friction.

35 The doctor assemblies according to Figures 1 and 2 can be installed, according to Figure 3, in two alternative ways

depending on the space available, by only moving the blade holder to the opposite side of the holder frame. Frame component 23 can be attached to the paper machine structure at the location of the doctor in a relatively unrestricted manner. 5 Because the doctor assembly is quite light, the loading on the frame is much less than previously.

According to Figure 4, jointed bearing assembly 14 can be implemented by using a separate tube 26 as the joint axle, the 10 outer surface of which forms the necessary joint pin 17. This tube 26 is secured, e.g., by means of screws 28 to the thin flange area 22. The screws can be fitted to tube 26 through holes 27 formed in tube 26. These holes do not create a problem, as they form an extremely small proportion of the total 15 surface area of the tube, and have nearly no lateral loading. If necessary, lubricating water can be fed to the joint through these holes.

Figures 1 and 2 shows clearly that components I and II can be 20 manufactured from a suitable composite material, such as the various fibre-reinforced plastics. The opposing parts of the jointed bearing assembly would be integrated directly in these components.

25 The doctor according to the invention is also suitable for use with a suction roll, i.e. the solution may be of the foil blade type. In this case, the cleaning of the roll refers mainly to the removal of water.



**Claims**

1. A doctor assembly in a paper machine, which is intended to clean a moving surface (P), such as a roll (T), a felt or a wire, and which includes
- a surface (P) against which a doctor blade (10) is set,
  - a blade support (12) for supporting the doctor blade (10),
  - a frame (23),
  - a jointed bearing assembly (14), which supports the doctor blade (10) and is itself supported from the frame (23), and which is parallel to the doctor blade (10), and
  - loading devices (20, 20') between the blade support (12) and the frame (23) for turning the doctor blade (10) in relation to the frame (23) and for pressing the doctor blade (10) against the surface (P) with a selected pressure;
- and in which the jointed bearing assembly (14) between the blade support (12) and the frame (23) consists of a joint sleeve (16) fixed to one of these components (I) and an operational joint pin (17) fixed to the opposing component (II) and the joint pin is installed to rotate in joint sleeve (16), characterized in that the jointed bearing assembly (14) extends essentially over the entire width of the doctor blade (10), either continuously or discontinuously.
2. A doctor assembly according to Claim 1, characterized in that the jointed bearing assembly (14) is formed in such a way that
- there is a gap (R) parallel to the joint axis in the joint sleeve (17) set in the first component (I),
  - the opposing component (II) includes a thin flange area (22), by means of which it extends through the aforesaid gap (R) to its joint pin (17) set in the joint sleeve (17), so that the joint pin (17) can rotate to a limited extent within the joint sleeve (16) with gap (R) limiting the degree of rotation of the thin flange area (22) and the related joint pin (17).

3. A doctor assembly according to Claim 2, characterized in that the joint sleeve (17) is installed in the bottom of a structure (15) with a U-shaped cross-section, in the first component (I).

5

4. A doctor assembly according to Claim 3, characterized in that the loading devices (20, 20') are located on each side of the thin flange area (22), between it and the claws (19, 19') of the U-shaped structure (15).

10

5. A doctor assembly according to one of Claims 1 - 4, characterized in that the blade support (12) consists of a blade holder (11) and a holder frame (13, 13') connected to the jointed bearing assembly (14).

15

6. A doctor assembly according to one of Claims 1 - 5, characterized in that the doctor assembly includes an oscillating device that is, as such, known, which is connected directly to the blade support (12).

20

7. A doctor assembly according to one of Claims 1 - 6, characterized in that the frame (23) forms a bearer (30), by means of which the doctor assembly is attached directly to the supporting structure of the paper machine.

25

8. A doctor assembly according to Claim 3 or 4, characterized in that the joint sleeve (16) of the jointed bearing assembly (14) is integrated directly with the first component (I) in such a way that the bottom surface of the U-shaped structure (13) forms the bearing surface.

30

9. A doctor assembly according to Claim 3, 4, or 8, characterized in that the joint pin (17) of the jointed bearing assembly (14) is integrated directly with the aforesaid opposing component (II) in such a way that a shape with a cross-section

35

corresponding to that of the axle (18) is formed in the end of the thin flange area (22).

10. A doctor assembly according to one of the above Claims 2 -  
5 4, 7 - 9, characterized in that at least one of the aforesaid components (I, II) includes an extruded fibre-reinforced piece.

11. A doctor assembly according to one of the above Claims 2 -  
4, 7 - 10, characterized in that the joint pin (17) of the  
10 jointed bearing assembly (14) is formed from a tube (26) attached to the end of the opposing component (II).

12. A doctor assembly according to one of the above Claims 1 -  
11, characterized in that the jointed bearing assembly (14)  
15 includes liquid-lubrication devices.

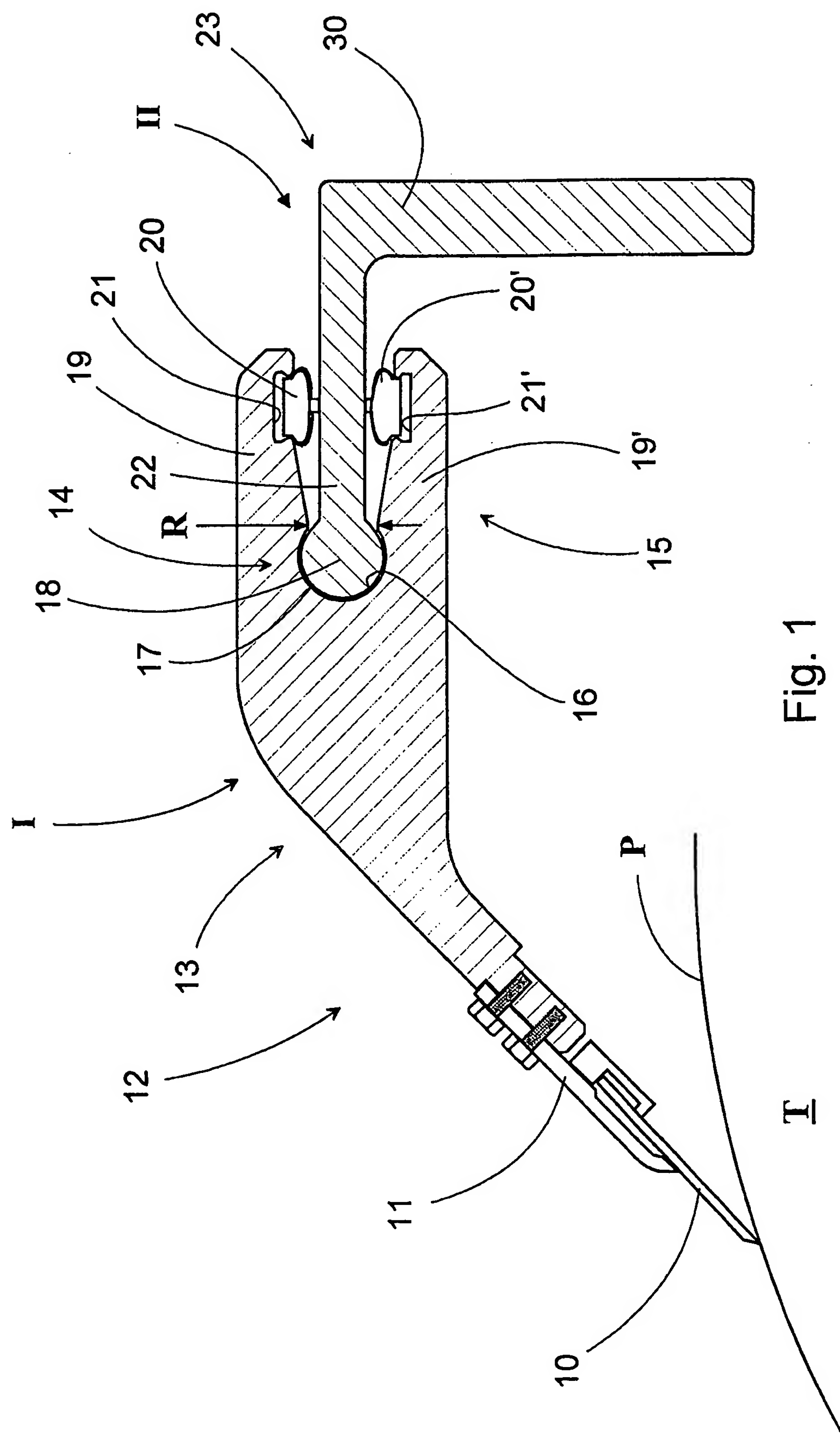


Fig. 1

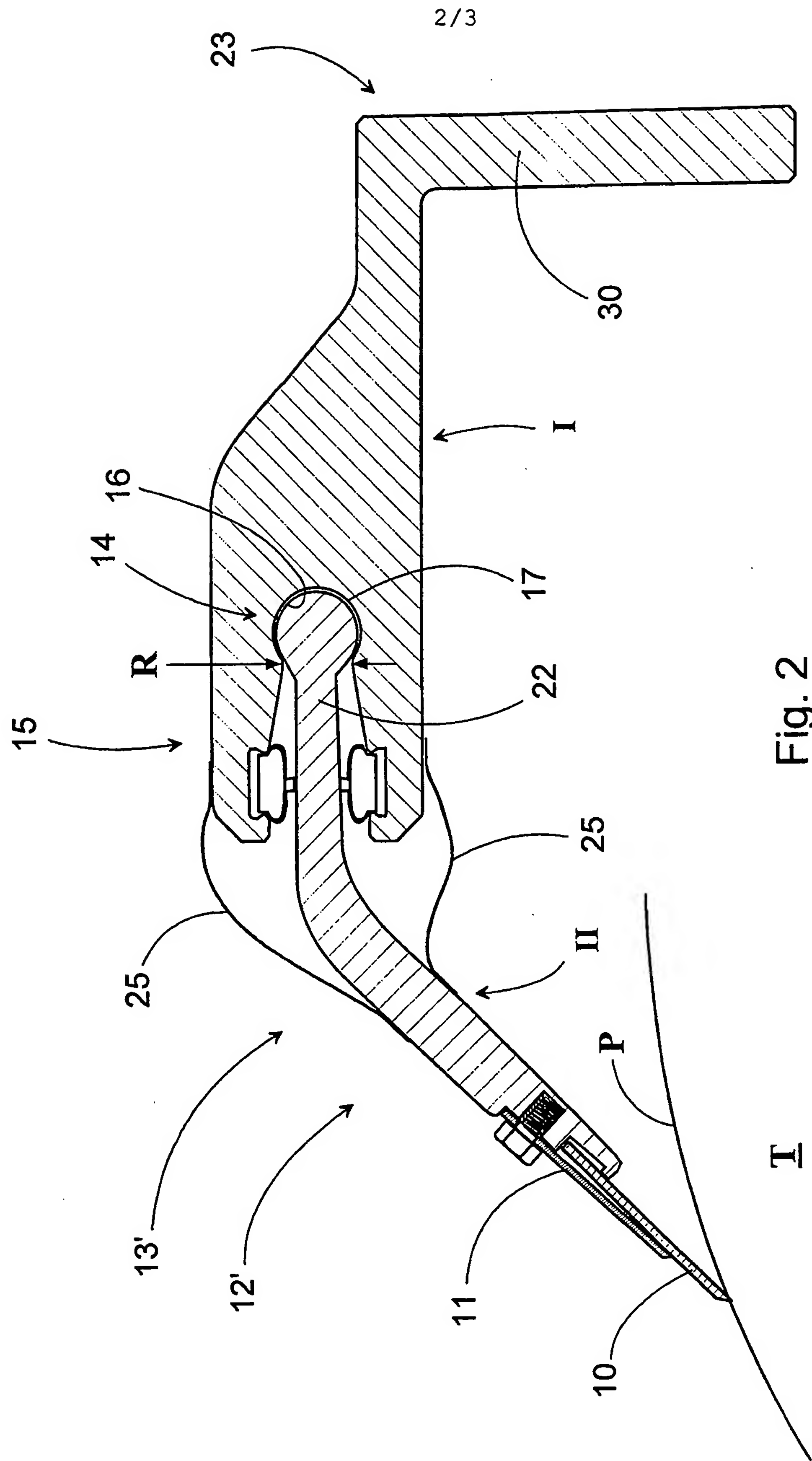
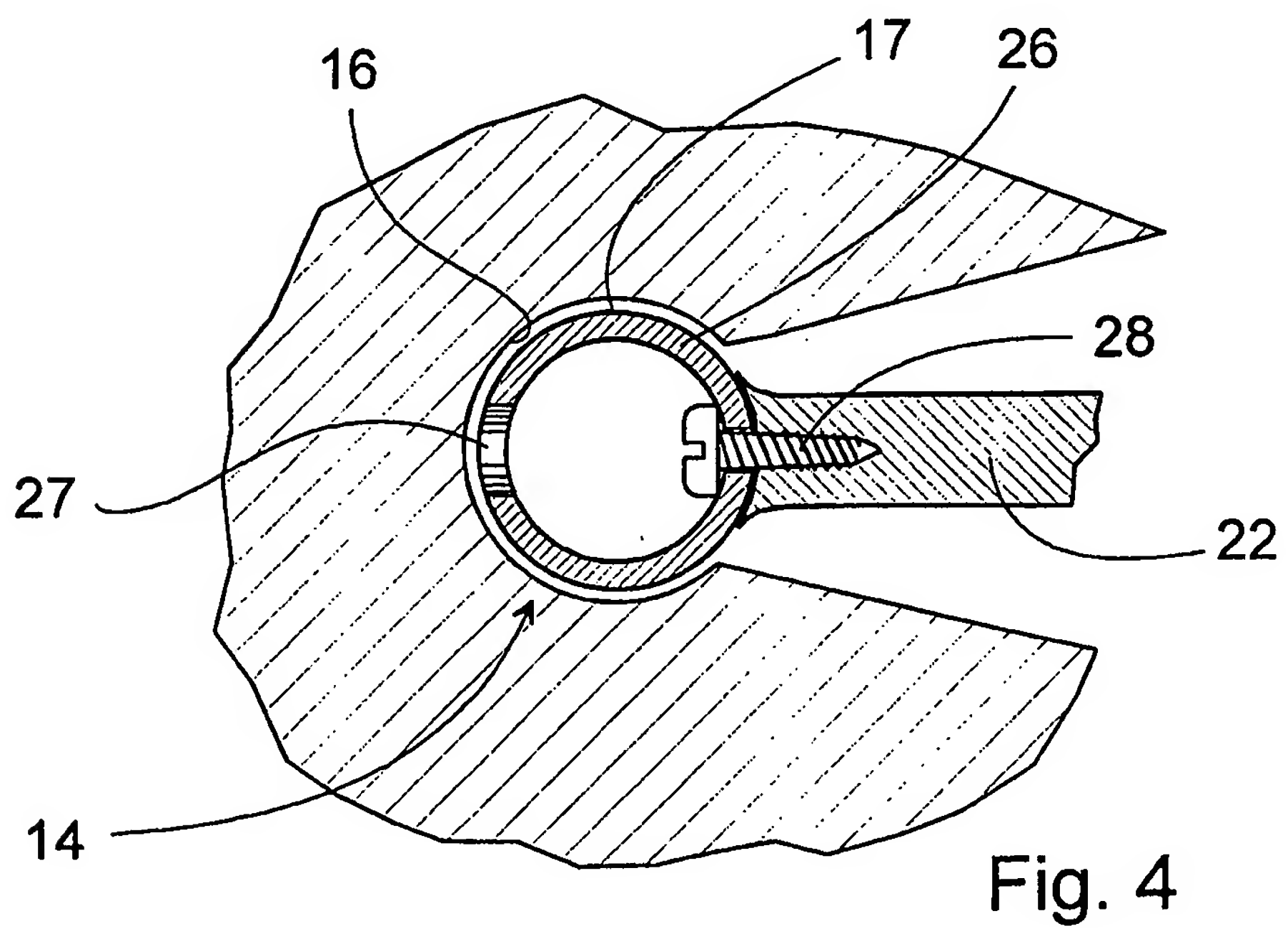
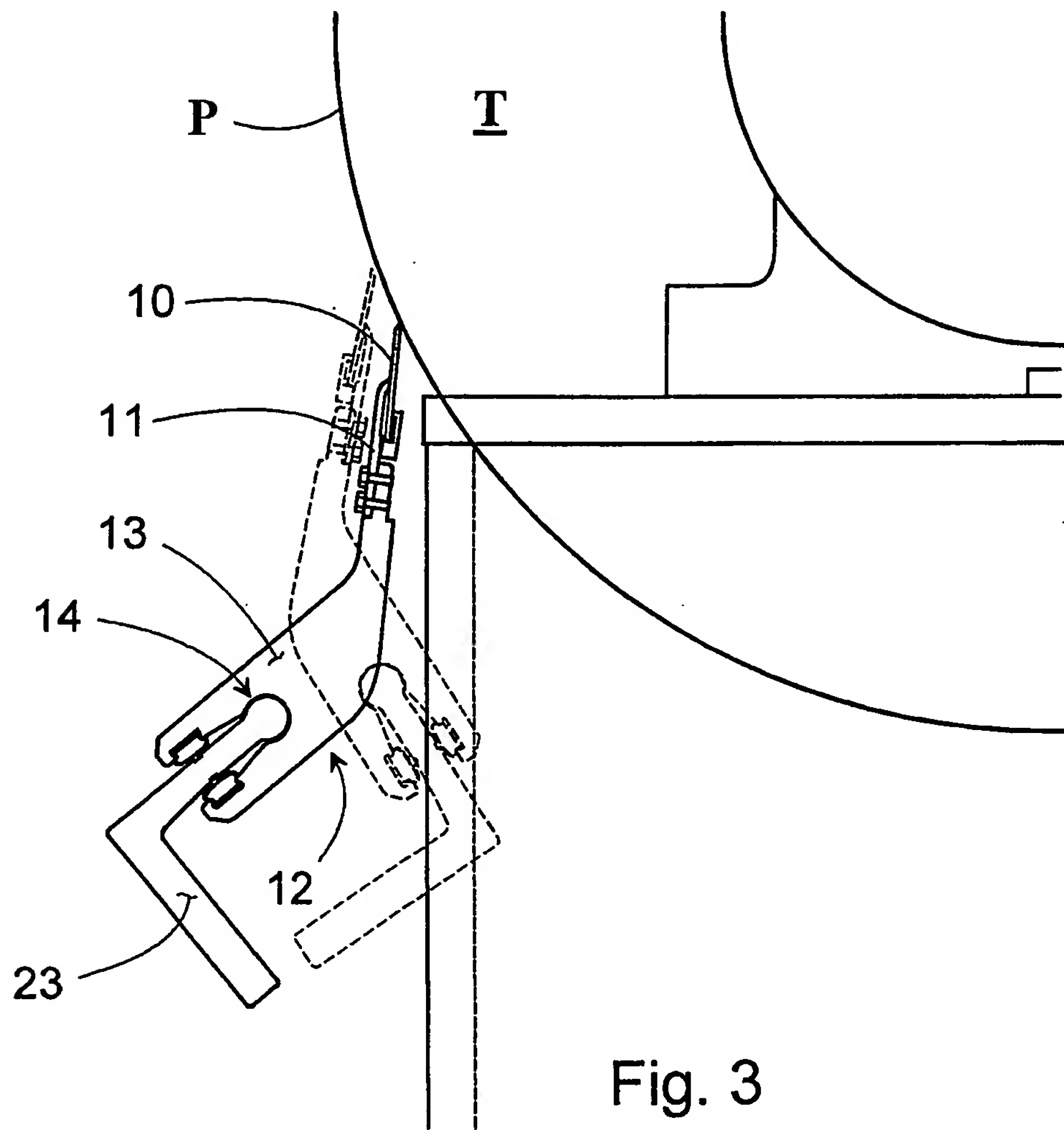


Fig. 2

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00064

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21G 3/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3803665 A (CHARLES BARRY WINTERBURN ET AL), 16 April 1974 (16.04.74), column 2, line 5 - line 10, figures 1,3 --	1-7,9-12
A	US 3748686 A (CHARLES BARRY WINTERBURN ET AL), 31 July 1973 (31.07.73) --	1-12
A	US 4906335 A (RONALD F. GOODNOW ET AL), 6 March 1990 (06.03.90) --	1-12
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9519310 A1 (SCHWARZE, HANS-OTTO), 20 July 1995 (20.07.95), abstract  -- -----	1-12

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Information on patent family members

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